

## Time machines

### To discuss ...

- How long does it take the light from the nearest star to get here..?
  - Four years.

The reason it takes so long for light to travel across outer space is because the distances across outer space are so enormous.  
(Enormous even for light, which travels at 186,000 miles per second!)
- So...suppose the closest star turned into a pumpkin. How long would it be before we knew it..? (How long before a pumpkin appeared in the night sky..?)
  - Four years, because it takes four years for the light to get here. So we'd see the same old star for another four years. (With or without a telescope, because a telescope can only magnify the light after it gets here.)

(Other stars are farther away, so light from other stars takes longer than four years to get here. In fact, some of the stars you can see in the night sky are so far away it takes a thousand years for the light to get here. So you see them as they looked a thousand years ago...)
- Scientists use telescopes to look at other stars and galaxies that are much farther away. How old is the light we see from distant stars and galaxies..?
  - Millions (even billions) of years old. That means we see them as they looked millions (or even billions) of years ago.
- Is it possible to see the Earth in the time of dinosaurs..? How could you do it..?
  - Yes. You would need a very powerful telescope, and you would have to be very far away from the Earth.

(You would need to be as far away as distant stars and galaxies that scientists see in a telescope in order for the picture you see of the Earth to be millions of years old...Earth in the time of dinosaurs..!)
- Astronomers are looking so far back in time with their telescopes, they know a bizarre secret about some of the faraway stars and galaxies they see. What is it..?
  - Some of them may no longer exist..! We're looking so far back in time, they might have burned out a long time ago. (Just like the dinosaurs..!)

Telescopes are truly "time machines." When astronomers use powerful telescopes to look across the vast reaches of space, they are stepping inside time machines and turning the dial back millions of years. They see a picture of the early Universe exactly as it appeared millions of years ago. It sounds astonishing, but it's an everyday fact of life for astronomers who study deep space.